ABSTRACT OF THE DISCLOSURE

Various embodiments of the present invention provide methods and systems for deterministic calculation of radiation doses, delivered to specified volumes within human tissues and organs, and specified areas within other organisms, by external and internal radiation sources. Embodiments of the present invention provide for creating and optimizing computational mesh structures for deterministic radiation transport methods. In general these approaches seek to both improve solution accuracy and computational efficiency. Embodiments of the present invention provide methods for planning radiation treatments using deterministic methods. The methods of the present invention may also be applied for dose calculations, dose verification, and dose reconstruction for many different forms of radiotherapy treatments, including: conventional beam therapies, intensity modulated radiation therapy ("IMRT"), proton, electron and other charged particle beam therapies, targeted radionuclide therapies, brachytherapy, stereotactic radiosurgery ("SRS"), Tomotherapy®; and other radiotherapy delivery modes. The methods may also be applied to radiation-dose calculations based on radiation sources that include linear accelerators, various delivery devices, field shaping components, such as jaws, blocks, flattening filters, and multi-leaf collimators, and to many other radiation-related problems, including radiation shielding, detector design and characterization; thermal or infrared radiation, optical tomography, photon migration, and other problems.